Scientific / Metrology Instruments
Benchtop Scanning Electron Microscope

Solutions for Innovation

NeoScope™
JCM-7000

Quality Control

Foreign Material Analysis

Elemental Analysis

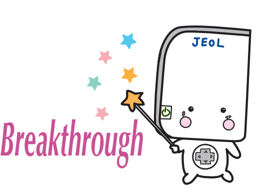
JEOL Ltd.

NeoScope™

JCM-7000

Optical Image to SEM observation with live Elemental Analysis

Zero
Live
Live
SMI



JEOL science class support
PR character "Rokumaru-kun"
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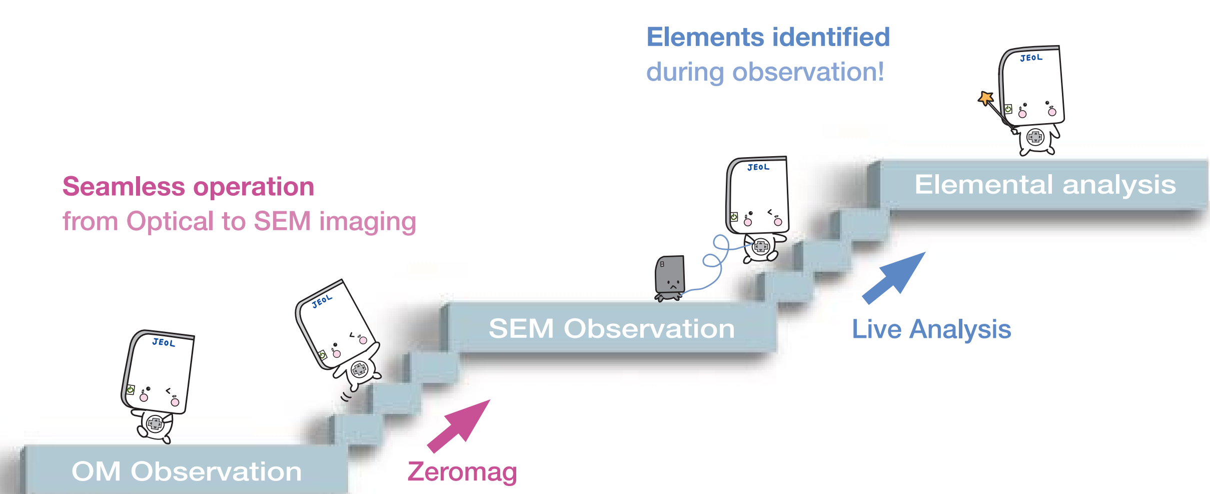
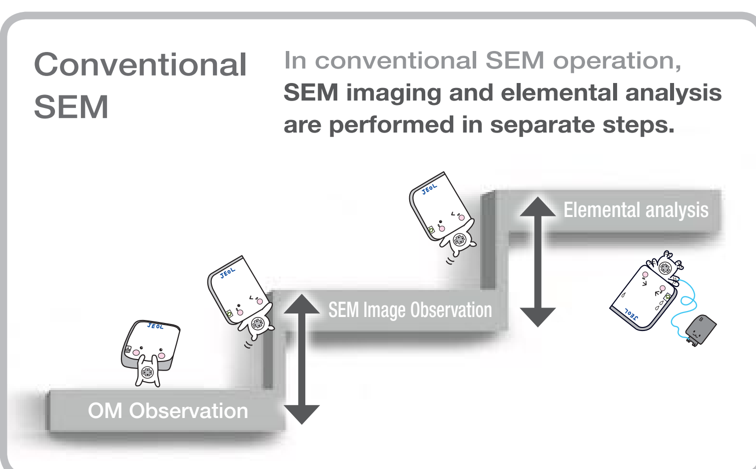
JCM-7000



Conventional SEM

In conventional SEM operation, **SEM imaging and elemental analysis are performed in separate steps.**



Functions for "Easy-to-use" SEM with seamless navigation and live analysis

- Zeromag: Automatic transition from optical image*1 to scanning electron microscope (SEM) image
- Live Analysis: Real time display of elemental composition*2 during image observation
- Auto: Advanced auto functions provide clear images from low to high magnification
- LV: Low Vacuum (LV) mode for imaging non-conductive specimens, without pre-treatment
- HV: High vacuum (HV) mode enables observation of detailed morphology
- 3D: 3D reconstruction **(Live 3D)** during image observation
- SMV: SMILE VIEW™ Lab links optical and SEM images, EDS data and locations for data review and reporting

*1 The stage navigation system (option) is required for Zeromag (optical image) image acquisition.
*2 An EDS system (option) is required.

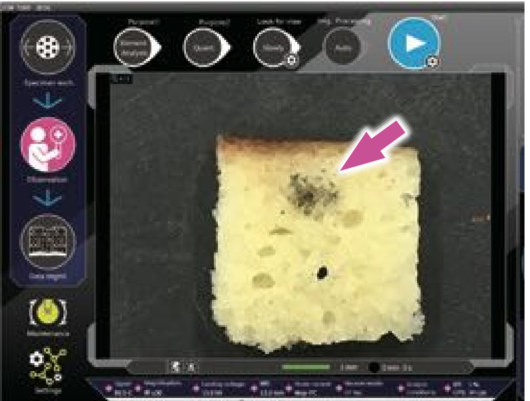
Improved work efficiency with JCM-7000

What is the foreign material observed with the optical microscope? Are there problems with the shape of the part? Was the raw material wrong? Quickly confirm the morphology and composition (constituent elements), which cannot be identified from an optical microscope

Efficiency UP Example 1-Foreign material analysis

Constituent elements can be verified and foreign materials can be identified instantly. Report creation is easy, so feedback to the manufacturing site can be performed quickly.
Example: Analysis of black substance on a food product

Example: Analysis of black foreign material adhered to a food product



Zoom

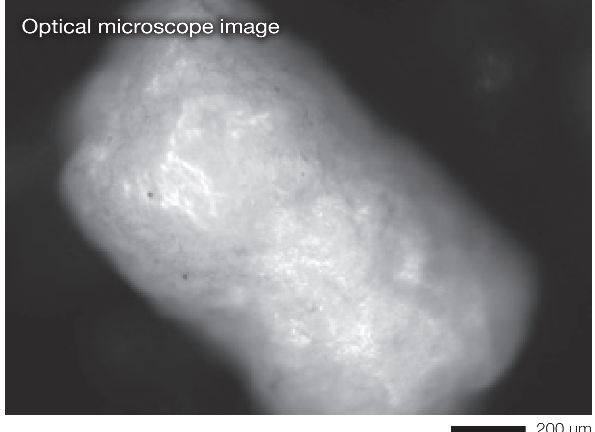
Find the foreign material with Zeromag (optical image) *1; then double-click to move it to the center of the field of view.
Enlarge the optical image with digital zoom.

When magnified to a certain enlargement, the SEM image appears overlaid on the Zeromag (optical image) *1

Efficiency UP Example 2-Quality control

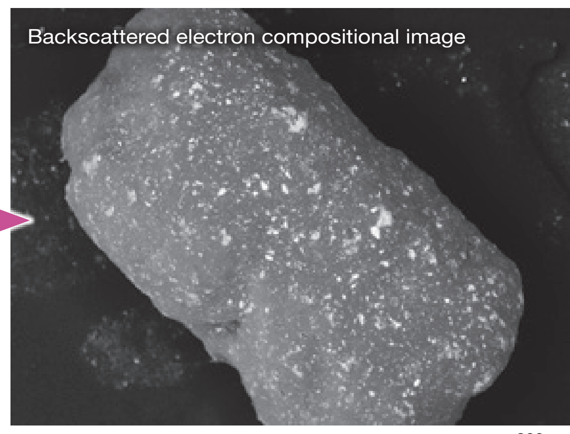
With SEM it is possible to observe the compositional contrast that cannot be seen on an optical image, so even at the same magnification, more detailed information can be obtained.
Observation and analysis can be performed with no specimen pre-treatment using the low-vacuum mode.

Example: Observe the distribution of a lubricant doped on a granule surface (pharmaceutical product)



200 µm

It is difficult to confirm the distribution of the white lubricant on the white granule (pharmaceutical product) with an optical microscope.



200 µm

Since the granule and lubricant have different compositions, the distribution of the lubricant can be clearly observed using the SEM backscattered electron compositional image.

With a backscattered electron compositional image, you can see particles that have a different composition (arrows)

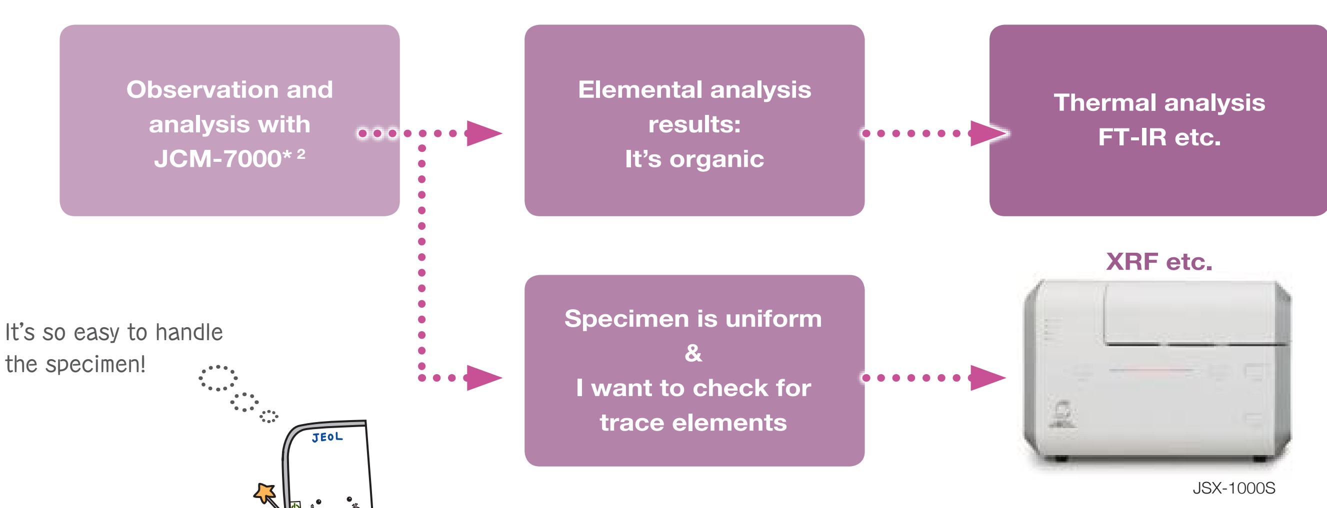
oom

The main constituent elements are displayed during observation

When the SEM image is enlarged to fill the entire screen, a spectrum of the main constituent elements are displayed*2 on the observation screen. A report can be generated simply by clicking the data management icon, enabling immediate feedback to the manufacturing site.

Efficiency UP Example 3-Screening

With JCM-7000, observation and analysis is possible without any pre-treatment of the specimen, so the same sample can be used for further analysis with other instruments after the measurement.



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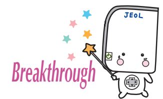
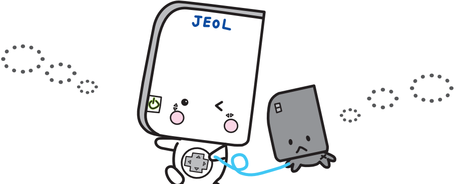
*2 An EDS system (option) is required.



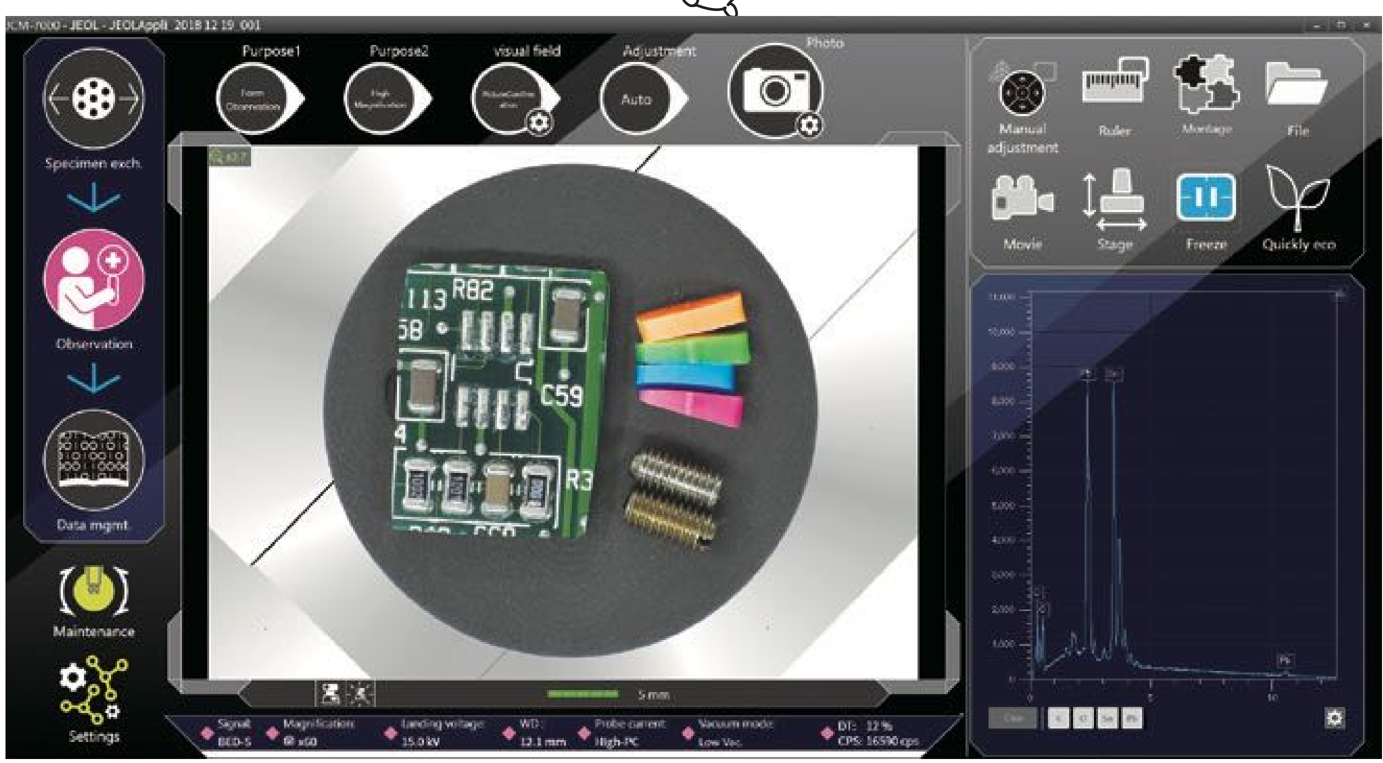
Easy Operation with JCM-7000

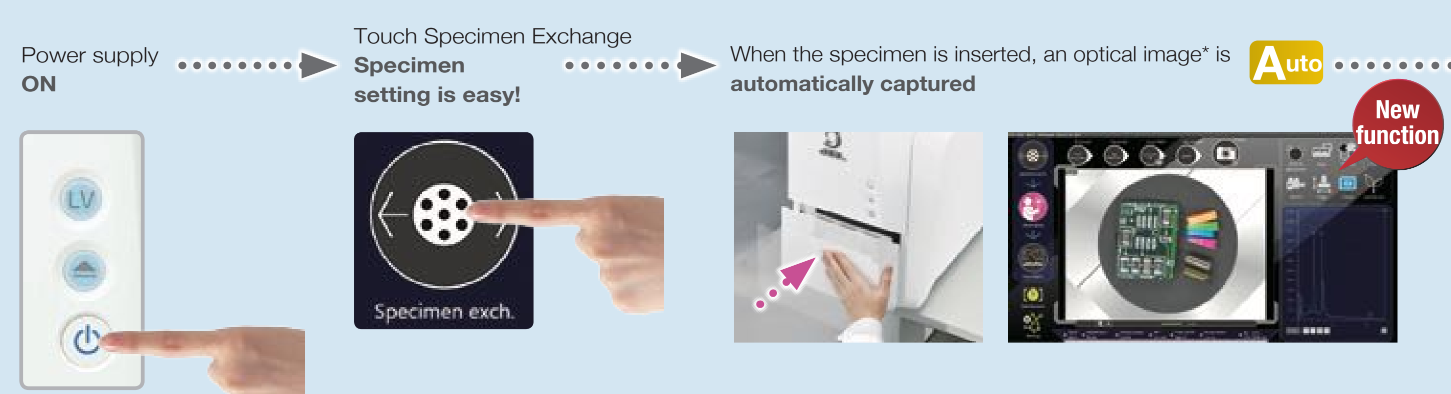
Everyone should be able to use SEM. That is why we pay so much attention to ease of operation.

The buttons on the left guide the workflow and the buttons on the top show the procedures for the current operation.

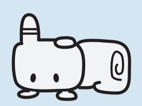


With Zeromag*, an optical image of the entire stage movement range (32 mm ϕ) can be viewed.





Automatic optical image capture when a specimen is inserted!



JCM-7000

NeoScope™ Benchtop SEM

INSTALLATION FACILITIES REQUIREMENTS

JCM-7000-IFR-20191017

JCM-7000 Installation Facilities Requirement Guide.

Revision 20191017
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Installation Requirements

1.1.1 Power supply

Power supply voltage: Single phase 100 VAC (120 V, 220 V, and 240 V supported), 50/60 Hz,
Maximum 700 VA (100 VAC), 840 VA (120 VAC), 880 VA (220 VAC), 960 VA (240 VAC)

Allowable power supply voltage variation range:

At 100 V: 90 to 110 V
At 120 V: 108 to 132 V
At 220 V: 198 to 242 V
At 240 V: 216 to 250 V

Grounding is necessary.

1.1.2 Grounding terminal

Ground resistance: 100 Ω or less (Type D) required

1.1.3 Installation room environment

Room temperature: 15 to 30°C [60 to 85°F]

Humidity: 30 to 60% RH (No condensation)

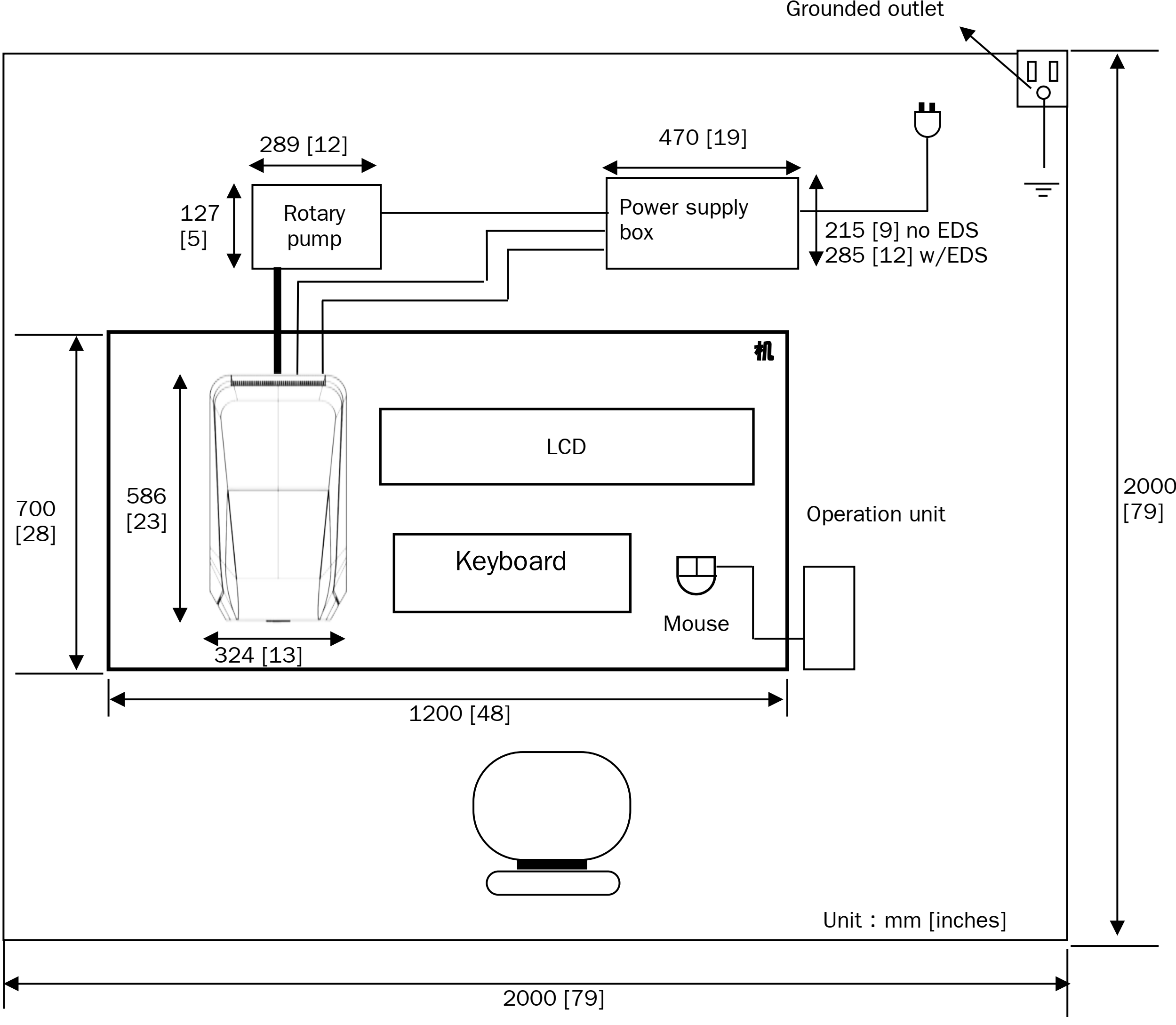
Stray magnetic fields: 0.3 μT or less (50/60 Hz, sine wave)

Installation table load capacity: **A robust 700 x 1200 [28 x 48] table with a 100 kg [220] or more capacity. (Customer supplied)**

Dimensions and weight: Dimension: mm [inch] Weight: Kg [lbs]

	Width	Depth	Height	Weight
Column unit (cover included)	324 [13]	586 [23]	566 [23]	67 [148]
Power supply box with EDS option Without EDS option	285 [12] 215 [9]	470 [19] 470 [19]	330 [13] 270 [11]	23 [51] 13 [29]
Rotary pump (RP): 1 unit	289 [12]	127 [5]	6237 [246]	9 [20]

Installation Layout



NOTES

1. The above figure shows a typical installation layout of the instrument. Be sure to secure service areas at the left and back sides even if only a small installation space is available.
2. Install the microscope as far as possible from instruments and facilities that may generate vibrations or electromagnetic waves (such as a road, busy corridor, railroad, elevator, air conditioner and its air outlet, and power transmission lines).
3. It is not necessary to provide blackout facilities in the installation room for this instrument.

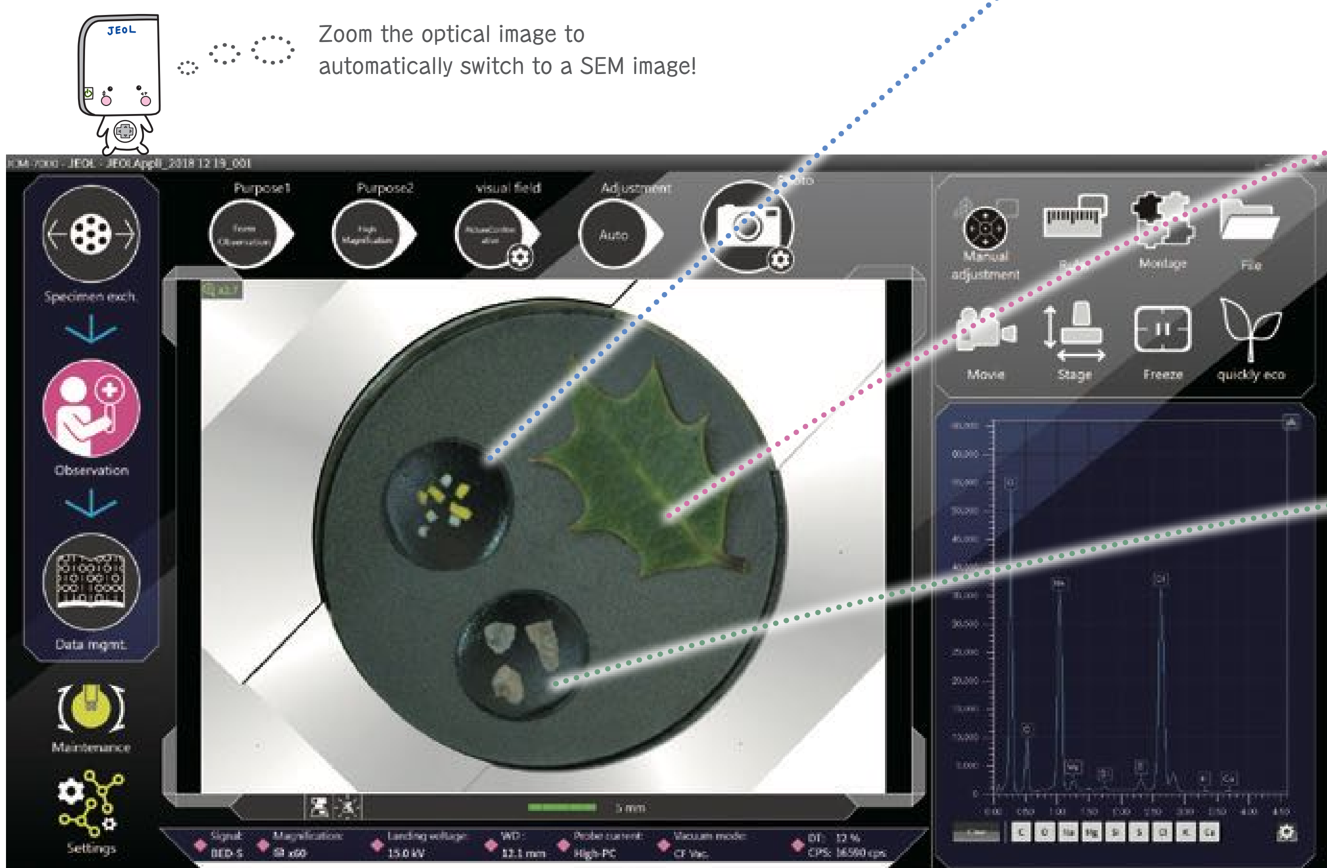
Seamless transition from Optical to SEM imaging!

Zeromag* & Low-Vacuum Mode

Zeromag*

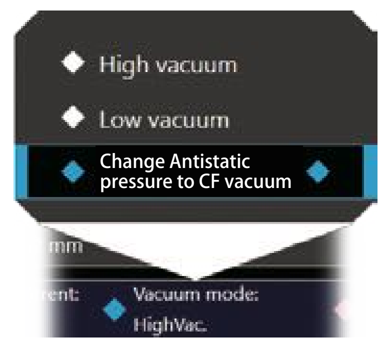
An optical image is automatically acquired when the sample is inserted.
Search for the field of view on the optical image, then zoom in on the target to automatically switch to an SEM image. Moving to the observation position is easy for quick SEM image acquisition with a minimal number of steps.

Zoom the optical image to automatically switch to a SEM image!

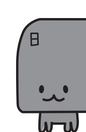


Low-vacuum (L-Vac.) mode

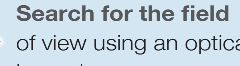
In addition to the high-vacuum mode for clear SEM observation of surface morphology, the JCM-7000 is also equipped with a 2-stage low-vacuum mode to view non-conductive specimens without pre-treatment.



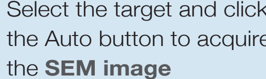
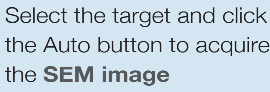
Viewing is simple with no pre-treatment needed for non-conductive samples.



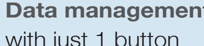
Zeromag
Live Analysis
Live 3D
SMILE VIEW™ Lab



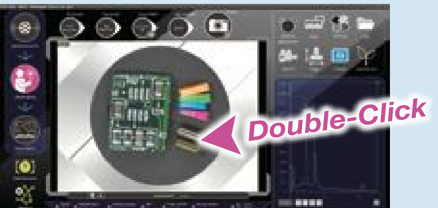
Search for the field of view using an optical image*

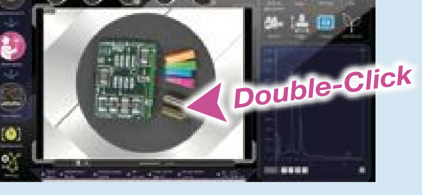



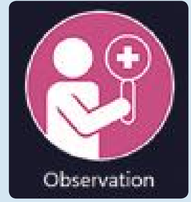
Select the target and click the Auto button to acquire the **SEM image**

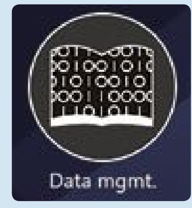


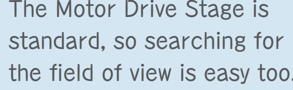
Data management with just 1 button





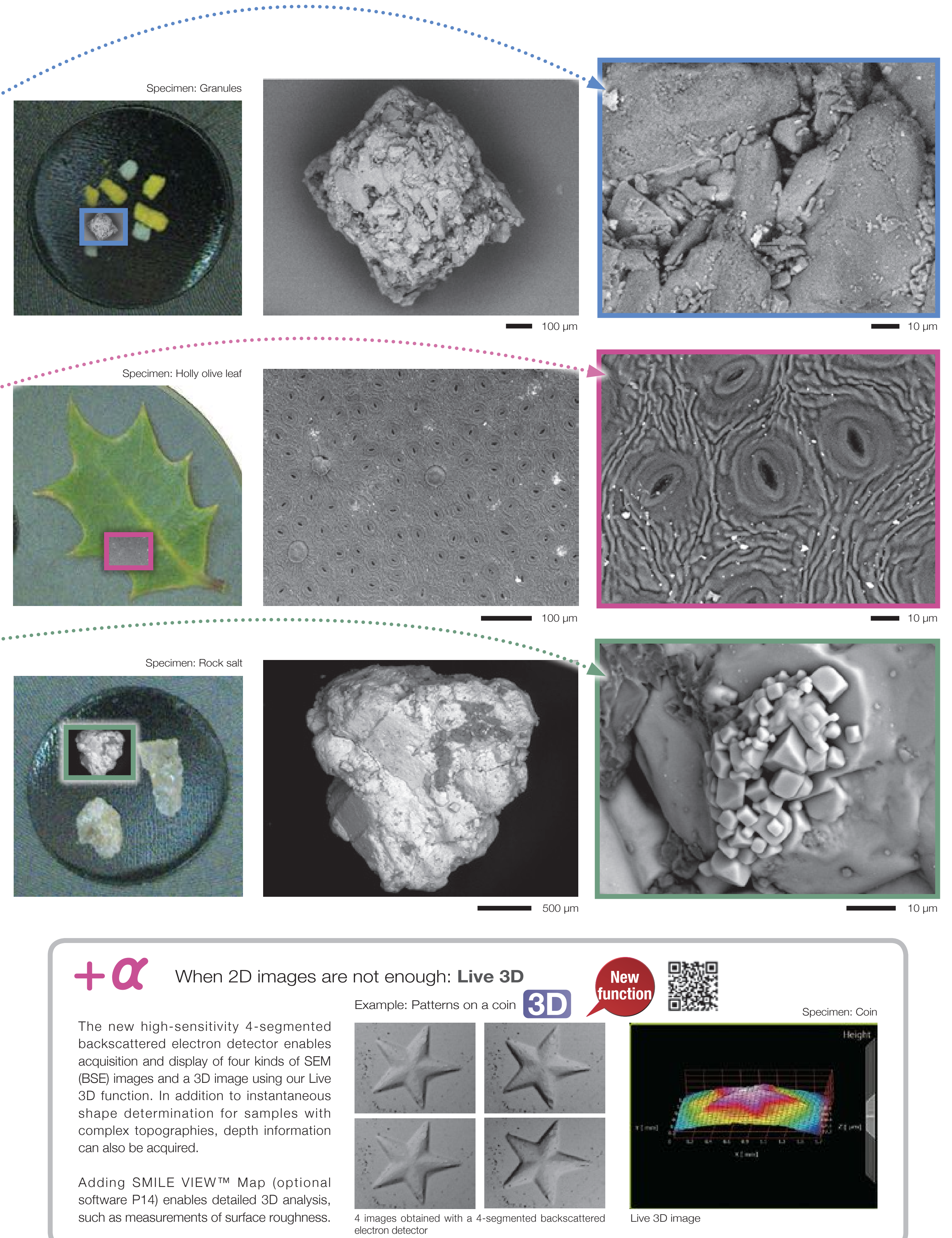






The Motor Drive Stage is standard, so searching for the field of view is easy too.

* The stage navigation system (option) is required for Zeromag (optical image) image acquisition.



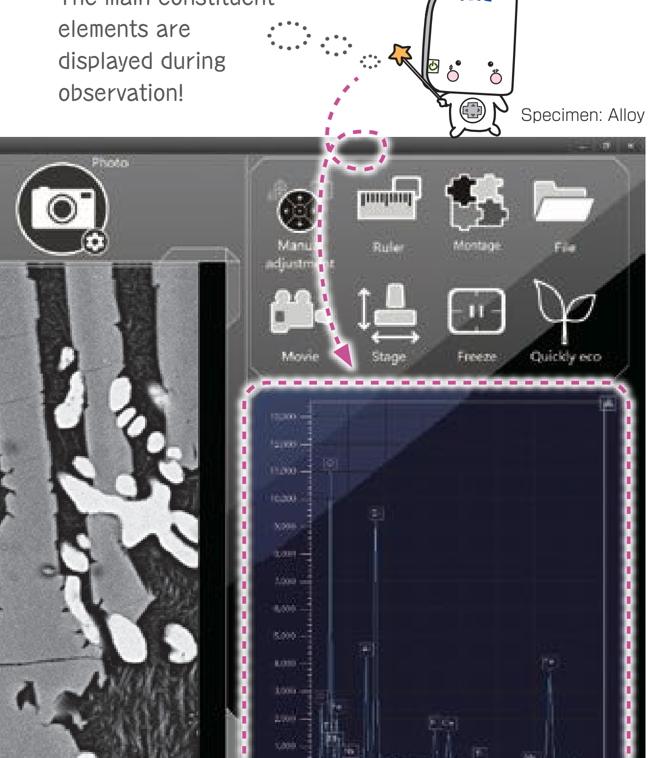
* The stage navigation system (option) is required for Zeromag (optical image) image acquisition.

Seamless transition from SEM imaging to EDS Analysis*

Live Analysis & Live Map

With Live Analysis, SEM observation and EDS analysis are no longer separate steps. The X-ray spectrum with the main constituent elements are displayed in Real Time on the observation screen. The JCM-7000 also includes Live Map to view the spatial distribution of the elements in Real Time. Live Map increases the probability of finding the elements of interest as well as detecting unexpected elements.

Screening while performing observation with Live Analysis



Detailed analysis in the analysis screen

Use the [Purpose] button to select elemental analysis or elemental mapping, for detailed EDS analysis.
Specify an analysis position on the observation screen to obtain a spectrum and element map.

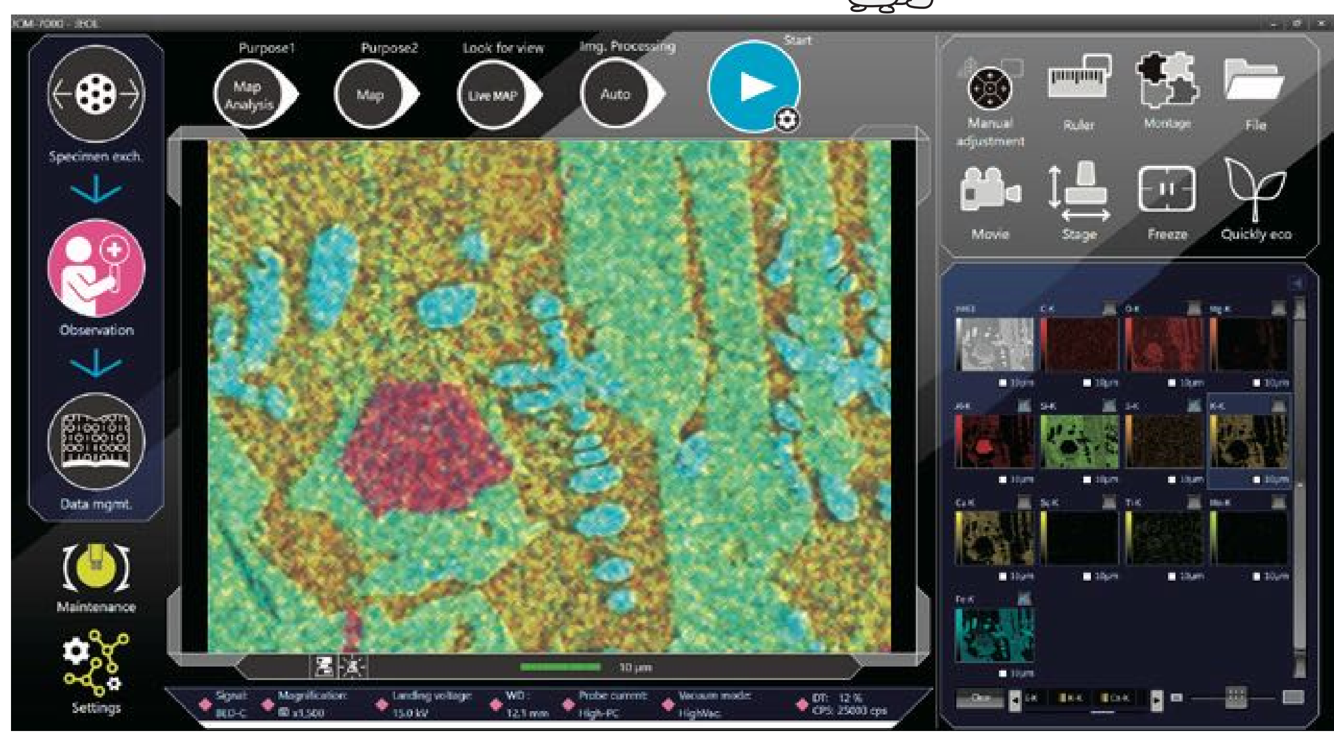
Qualitative/quantitative analysis

Automatic qualitative/quantitative analysis of the acquired spectrum

Quant. Type	Element	Line	keV	Mass%	Atom%	K rat
Automatic	C	K	0.277	16.53±0.21	28.53±0.37	
Automatic	O	K	0.525	35.52±0.32	46.04±0.42	
Automatic	Mg	K	1.253	1.23±0.05	1.05±0.04	
Automatic	Al	K	1.486	17.35±0.17	13.34±0.13	
Automatic	Si	K	1.739	0.24±0.02	0.18±0.02	
Automatic	Ti	K	4.508	0.64±0.05	0.28±0.02	
Automatic	Cr	K	5.411	0.42±0.04	0.17±0.02	

Quickly check the distribution of the main constituent elements with Live Map

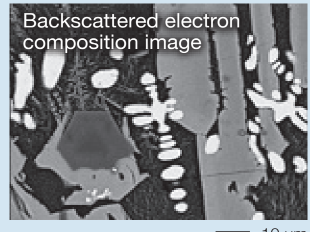
Our high sensitivity detectors allow for live EDS map



* An EDS system (option) is required.

Elemental maps

Elemental maps of the observation area can be displayed.

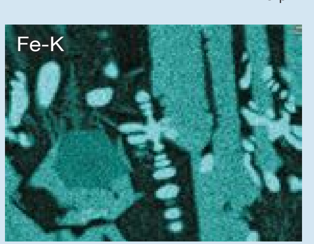


10 µm

10 µm

Si-K

10 µm



10 µm

Advanced analysis functions

Visual Peak ID (VID):
Spectrum reconstruction built-in makes it easy to verify composition.

Probe tracking:
Corrects for image shifts during long acquisitions.

Pop-up spectrum:
Extracts a spectrum from the map results.

Real time filter:
Provides easier viewing of elemental maps as they are being acquired.

Relocating analysis areas:
Accurate return to an area where data was collected.

Particle analysis (Option):
Particles are identified, sorted by class or subjected to elemental analysis to classify the particles

Simple report creation and data management

SMILE VIEW™ Lab

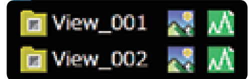
SMILE VIEW™ Lab is a fully integrated data management software program which links the optical images*1, SEM images, EDS analysis results*2 and corresponding stage coordinates for fast report generation or recall of specimen position and SEM conditions for further study.

SMILE VIEW™ Lab data management screen

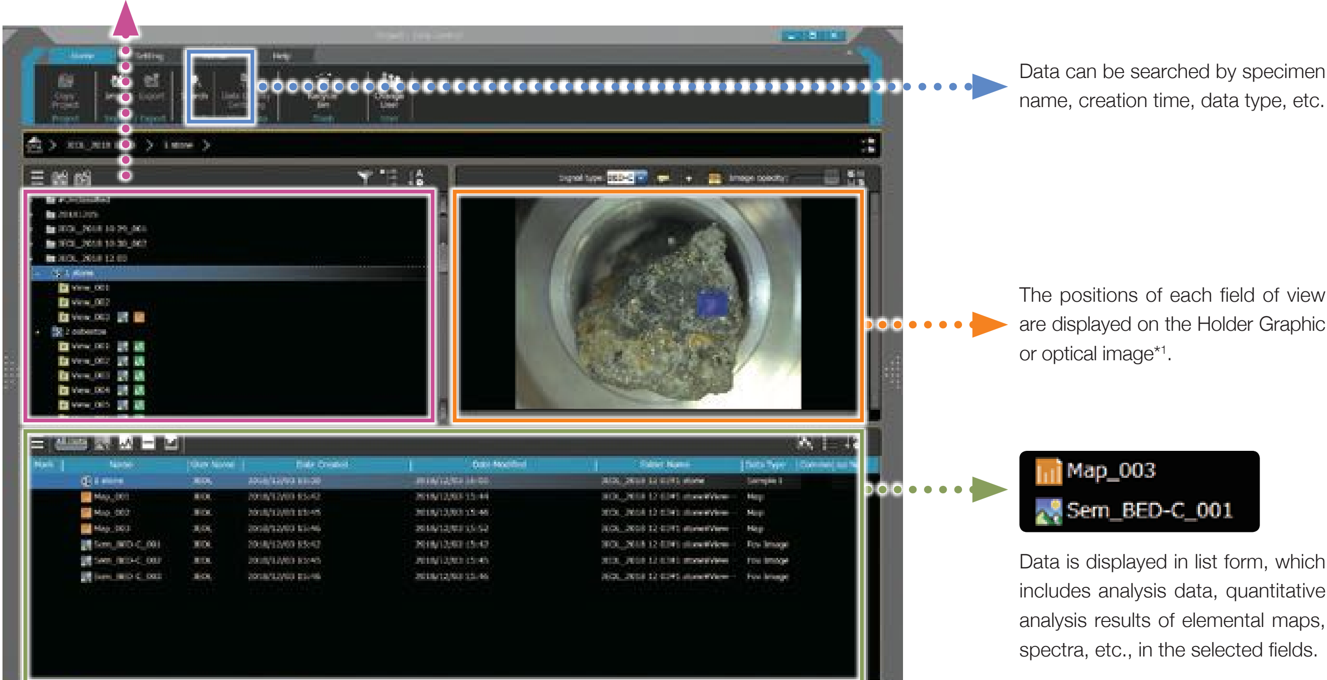
SMILE VIEW™ Lab Data management screen allows you to easily handle all your data. Our data manager links the observation position, observation & analysis results*2, and a low magnification image of the holder graphic or optical image*1. You can review or re-analyze already-acquired data and export selected data to a report.

【Features of SMILE VIEW™ Lab】

- Integrated management of Zeromag (optical image)*1/ SEM images/ EDS analysis results*2
- Allows for immediate understanding of data in each field of view
- A variety of data search functions
- Automatically sets the right layout for the data type selected
- Easy layout modification



The name of each field of view is displayed.



Data can be searched by specimen name, creation time, data type, etc.

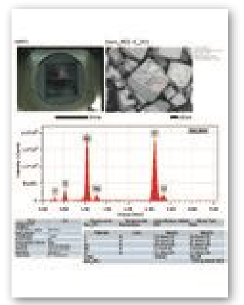
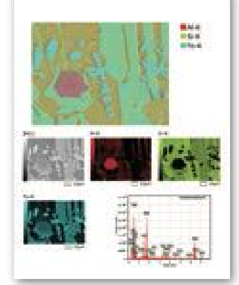
The positions of each field of view are displayed on the Holder Graphic or optical image*1.

Data is displayed in list form, which includes analysis data, quantitative analysis results of elemental maps, spectra, etc., in the selected fields.

*1 The stage navigation system (option) is required for Zeromag (optical image) image acquisition
*2 An EDS system (option) is required.
*3 A computer with Microsoft Office software installed is required.

Batch creation of reports

In the Data management screen, you can review or reanalyze data as well as generate batch reports from all the data, SEM images through analysis. The Data management screen can be opened using the Data management button or from the list of measured data. Once the data is selected, a report can be generated with just one click. Reports can be exported to PDF, Microsoft Word or PowerPoint®. *3

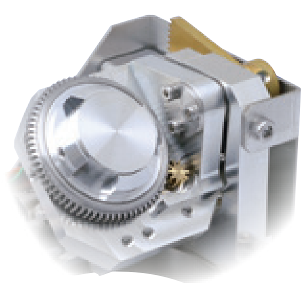



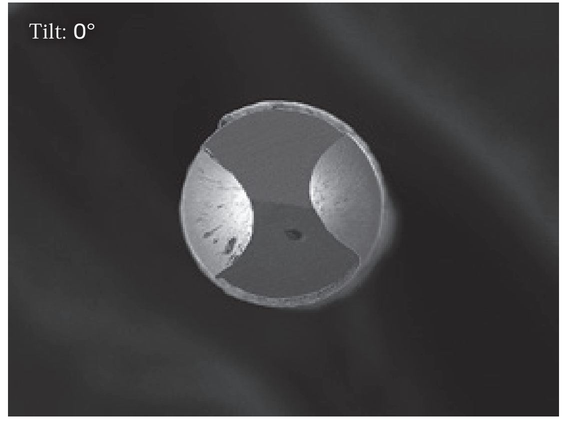
Report example

Options to extend SEM capabilities

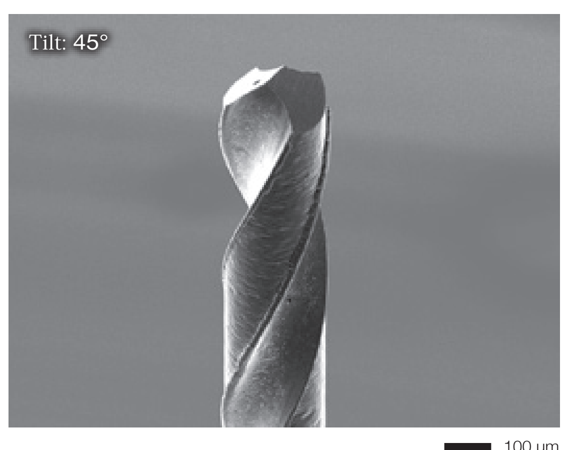
Tilting and Rotating Motor Drive Holder for viewing 3D shapes (option)

The Tilting and Rotating Motor Drive Holder enables observation of specimens at various angles.
Installation of this holder coupled with our 2-axis motorized stage provides 4-axis motorized control.





100 μm

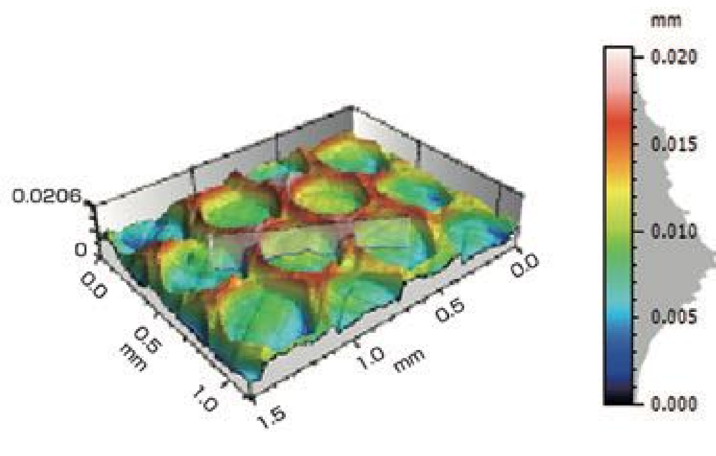


100 μm

Specimen: Drill blade
Accelerating voltage: 15 kV   Secondary electron image

Surface analysis in 3D SMILE VIEW™ Map (option)

Versatile software offering not only stereo-pair 3D reconstruction, but also 3D reconstruction from four images, coloration, image editing, and more.
Once a layout or workflow (operation procedure) is set, it can be saved, so that the same operation can be performed simply by entering the data, enhancing work efficiency. There is also support of various standards for surface analysis, such as ISO 25178.



SMILE VIEW™ Map
(Stereo-Pair 3D reconstruction)

Specimen: Scintillator

ISO 25178		
Height parameter		
Sq	0.00354	mm
Ssk	0.313	
Sku	2.52	
Sp	0.0111	mm
Sv	0.00953	mm
Sz	0,0206	mm
Sa	0.00288	mm

ISO25178
Surface properties (roughness measurement)

Discover a New World with JCM-7000

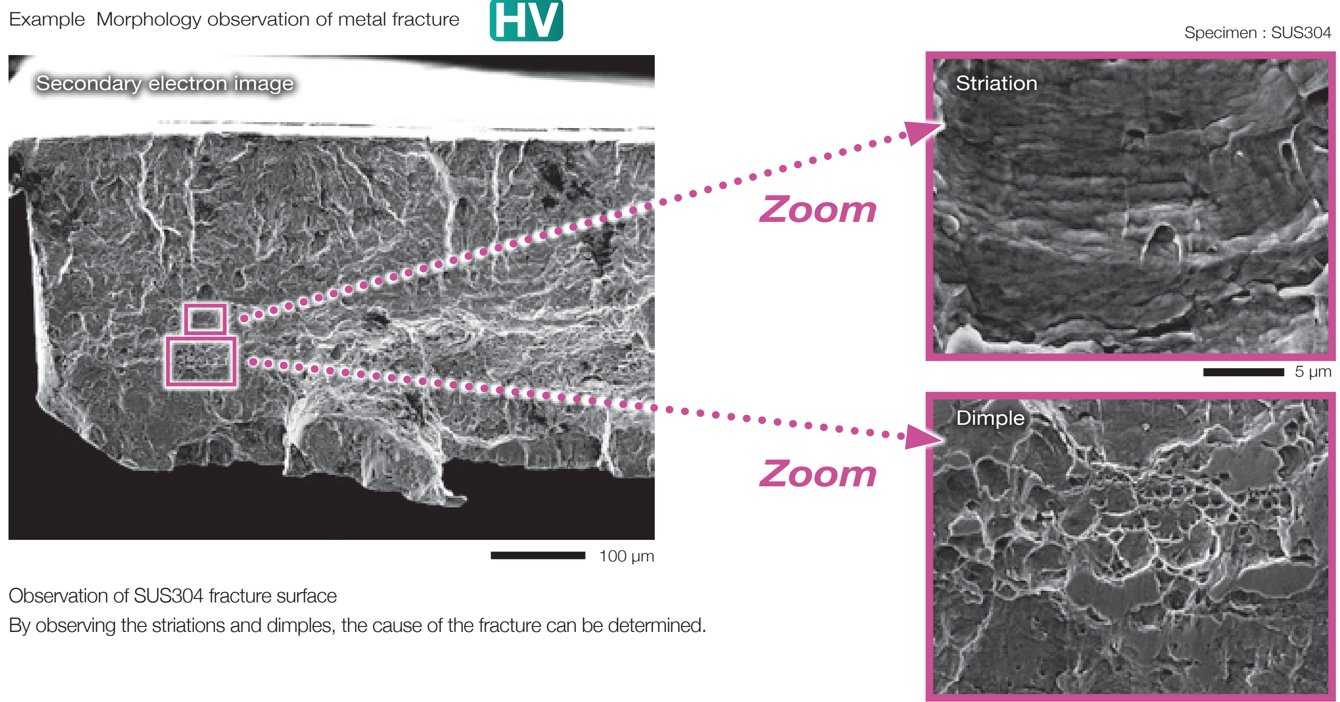
Metal

For conductive metal specimens, observation of surface details using the secondary electron image can be performed without coating.

With the JCM-7000, details of ductile or brittle fracture can be analyzed, including surface morphology of the fracture, elemental analysis* of materials present at the starting point of a fracture, and identification of inclusions in metal.

Example Morphology observation of metal fracture **HV**

Specimen : SUS304



Observation of SUS304 fracture surface
By observing the striations and dimples, the cause of the fracture can be determined.

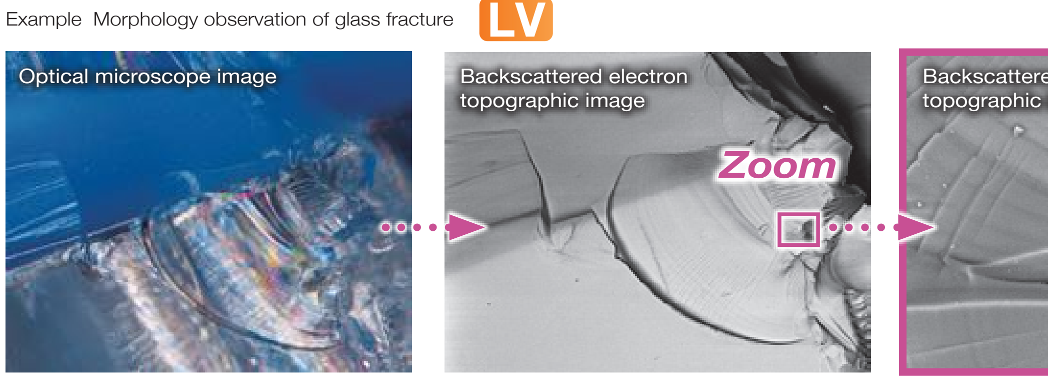
Ductile or brittle fracture on glass

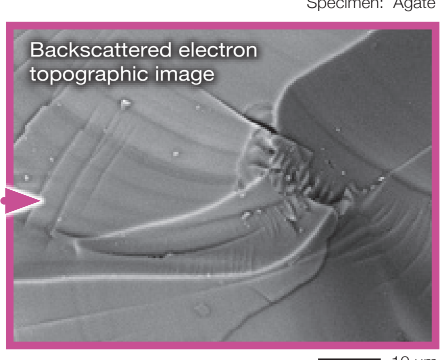
For the ductile or brittle fracture on transparent glass or plastics, it is difficult to confirm its top-surface state with an optical microscope.

Observation with the SEM makes it easy to find the starting point of a fracture and observe the detailed surface morphology.

Example Morphology observation of glass fracture **LV**

Specimen: Agate

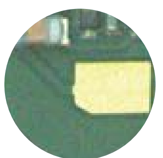




With the optical microscope, it is difficult to reveal information on the surface of this glass fracture.

SEM image at the same magnification as the optical microscope image (left) clearly reveals general information about the top surface of the same fracture specimen.

Enlarged view enables detailed observation.

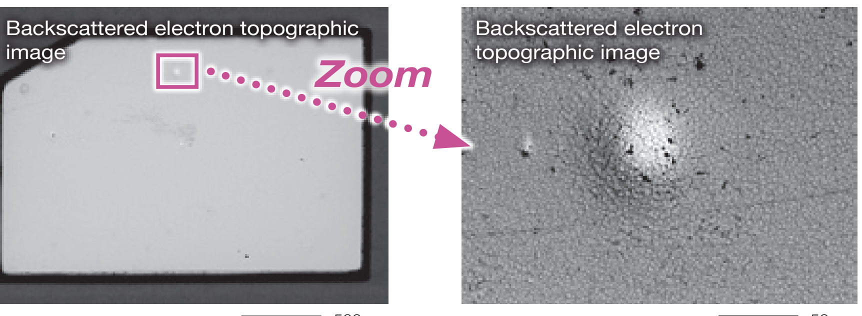


Printed circuit board

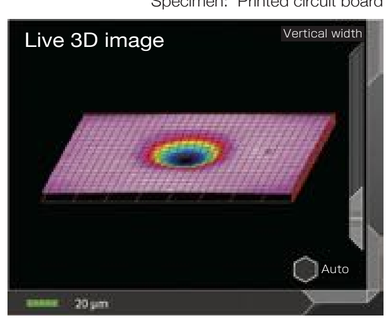
Low-vacuum mode is suitable for a printed circuit board (composite material). Owing to this mode, SEM observation and analysis* can be performed without adding a conductive coating.
The Live 3D function enables an SEM image (BEI, shadow) and a live 3D surface reconstructed image to be displayed simultaneously.

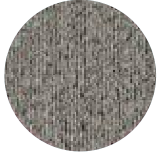
Example: 3D imaging of a defect on the pad of a printed circuit board and elemental analysis of foreign materials contained in the board

Specimen: Printed circuit board



500 µm 50 µm





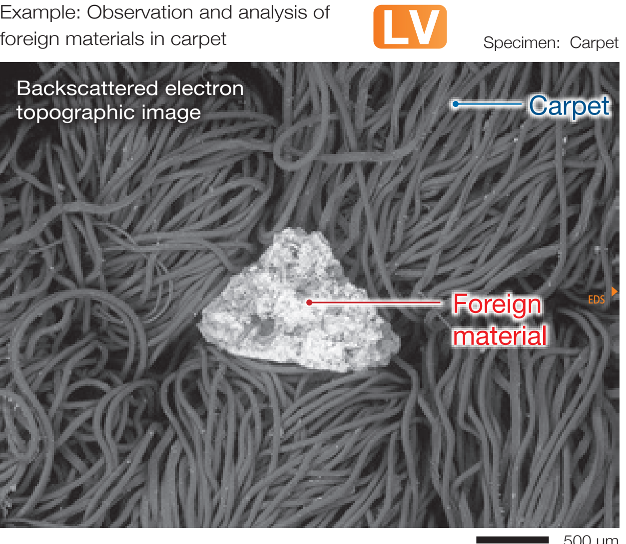
Fibers

For fibers with complex structure, adding a conductive coating is difficult. Low-vacuum mode makes it easy to perform morphological observation as well as analysis of foreign materials*.

Example: Observation and analysis of foreign materials in carpet

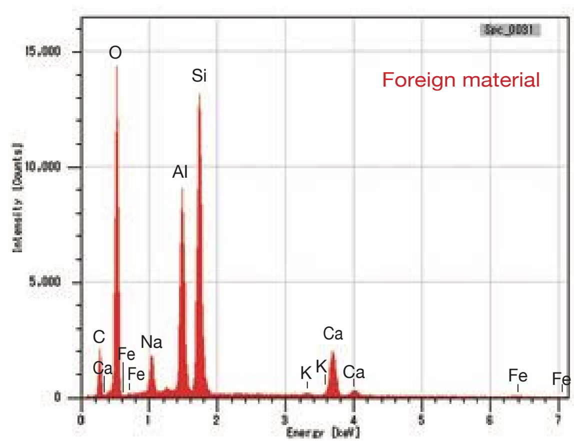
LV

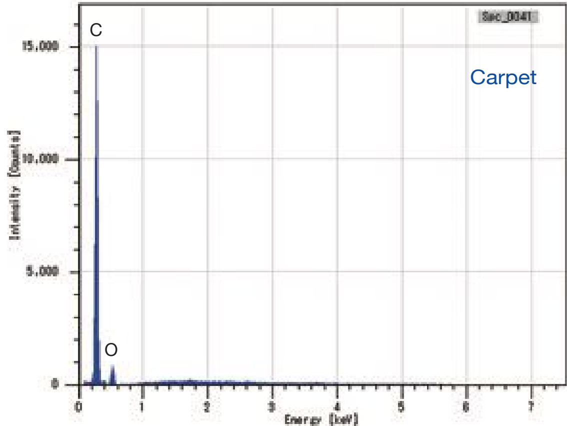
Specimen: Carpet



500 µm

* An EDS system (option) is required.





Food

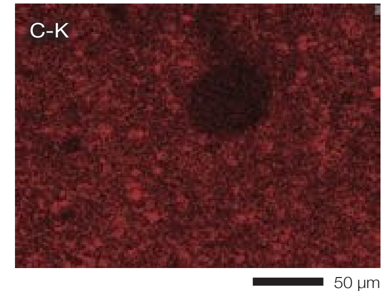
Low-vacuum mode is effective for observation and analysis* of food, which contains a lot of water or fats.
In particular for specimens that are susceptible to heat, the use of an LV cooling holder (option) allows for observation and analysis of the food specimen uncoated while preserving its structure.

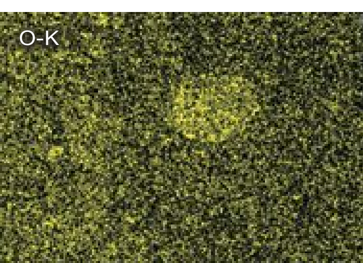
Example: Mineral distribution in processed cheese

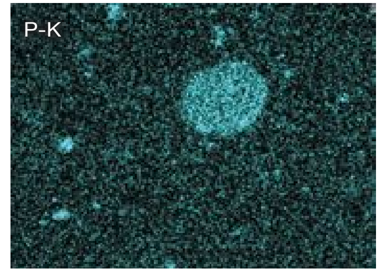
Specimen: Processed cheese

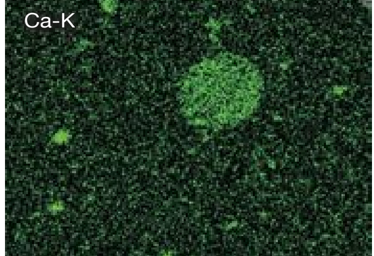
Backscattered electron compositional image

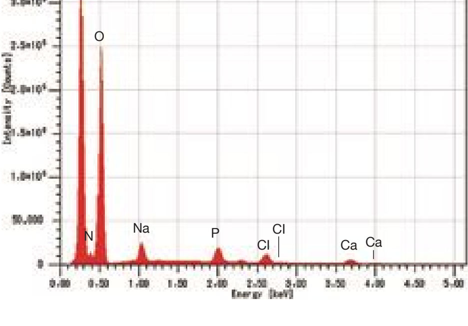
50 µm











Elemental maps reveal the distribution of minerals contained in cheese.

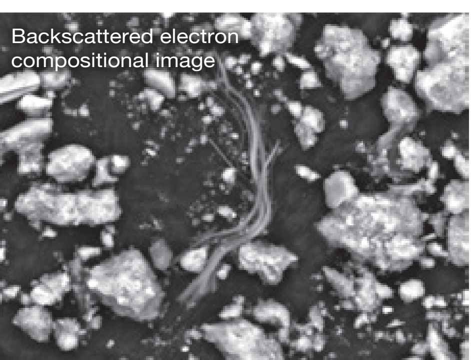
Asbestos

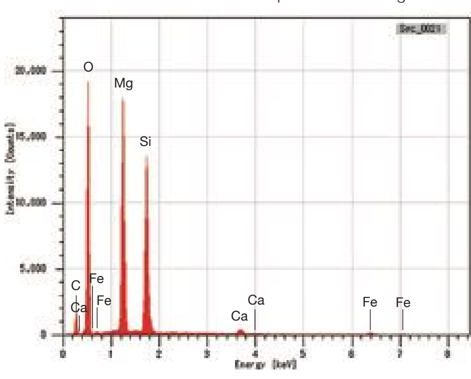
SEM/EDS enables determination of the presence or absence of asbestos in building materials by combining the results of morphological observation and compositional (elemental) analysis.
The Live Analysis function makes it possible to check the spectrum while observing the SEM images. This allows accurate, efficient judgment about the presence of asbestos when fibers are discovered*.

Example: Identification of chrysotile in building materials

Live Analysis

Specimen: Building material





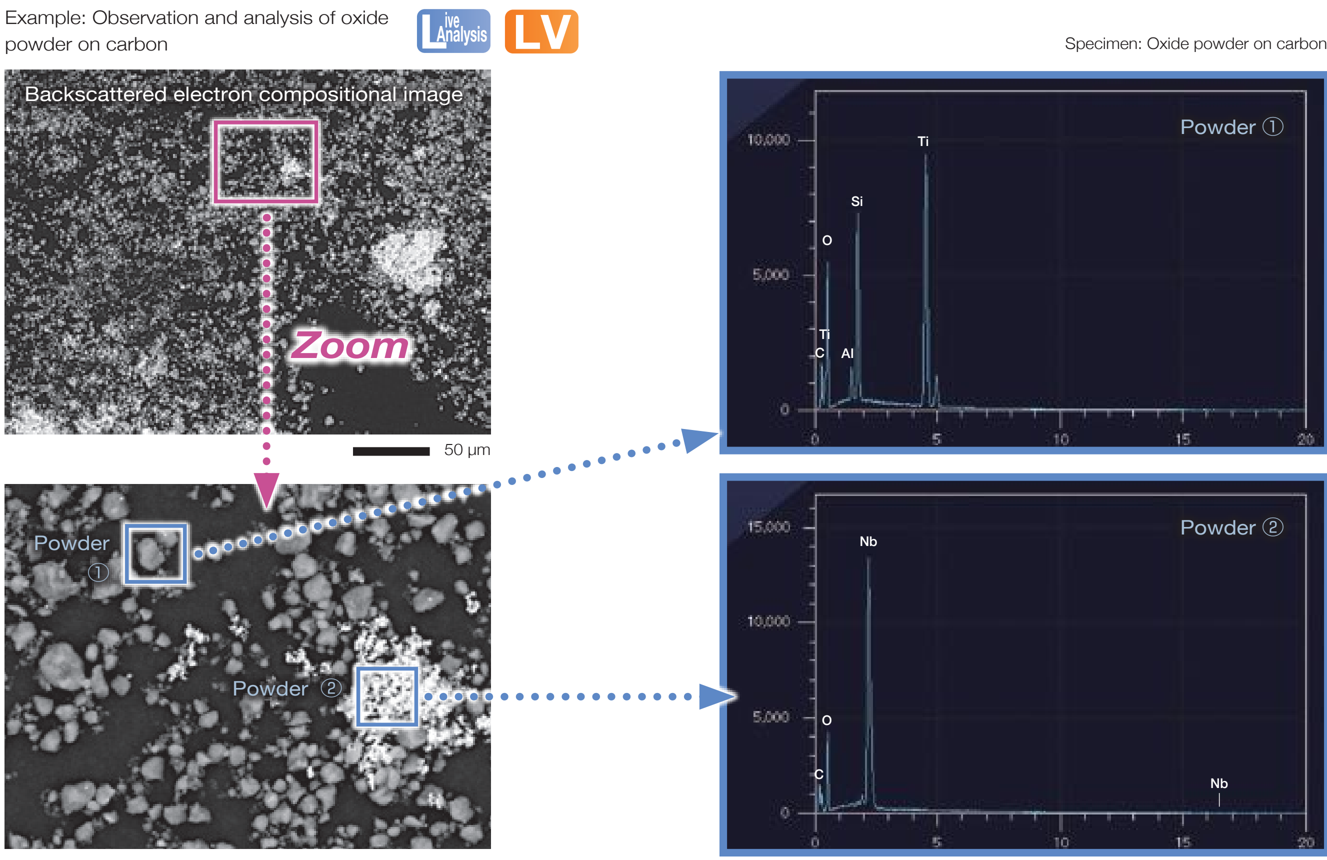
The probability to overlook asbestos is reduced owing to both morphological and compositional checks.

Powder

It can be difficult to identify the type of powder adhered to a component simply by the color.
With SEM, it is possible to identify the elements* as well as confirm details about the powder's morphology, particle diameter, and adhesion.

Example: Observation and analysis of oxide powder on carbon

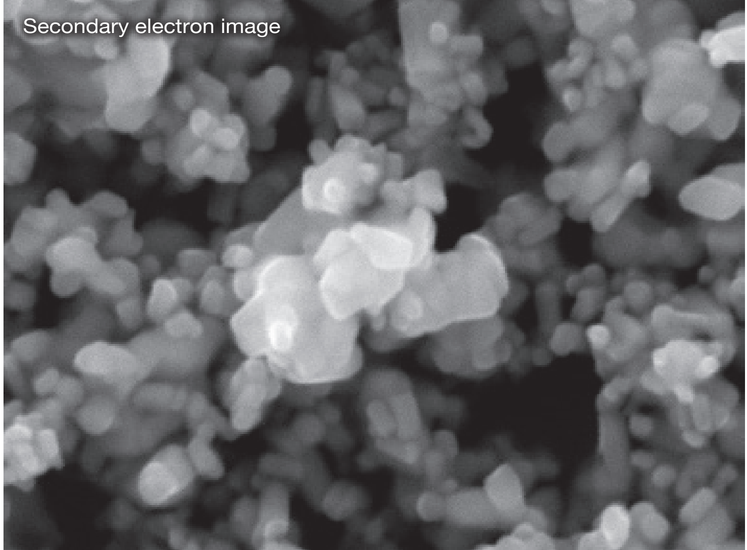
Specimen: Oxide powder on carbon



With a higher magnification backscattered electron composition image, it becomes apparent that there are 2 types of powder.

The elements contained in each powder can be identified.

Example: High magnification image of oxide powder



500 nm

By applying a metallic coating to the surface, high magnification images can be acquired in high-vacuum mode, even with oxides that are not conductive.

Specimen: Niobium oxide Pt coating
Accelerating voltage: 15 kV
Magnification: ×30,000

* An EDS system (option) is required.

Easy maintenance

Filament

Integrated filament-Wehnelt grid

Changing the filament is easy. The electron gun in the JCM-7000 uses a pre-centered cartridge that is integrated with the Wehnelt. The cartridge is replaced as a unit, thus making the exchange process fast while keeping correct positioning of the filament. In addition, it is possible to replace the filament inside the cartridge.

Automatic gun alignment

When a filament is replaced, alignment adjustment is required.
If adjustment is not made, it is difficult to obtain clear images.
Alignment adjustments are fully automated in the JCM-7000.

No need for special utilities

The JCM-7000 operates on a 100 V service outlet. Cooling water and liquid nitrogen are not required for SEM and EDS operation.
No special facilities are required for installation.

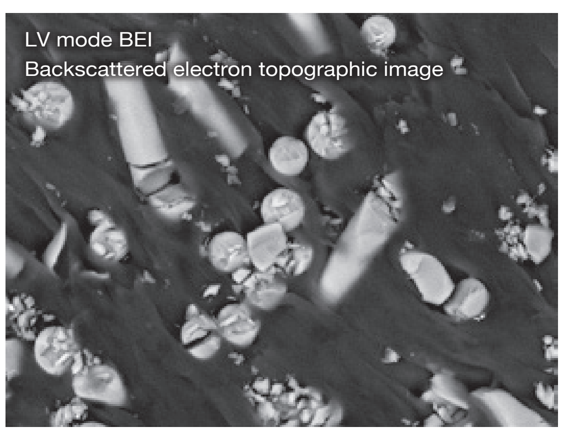
Peripherals

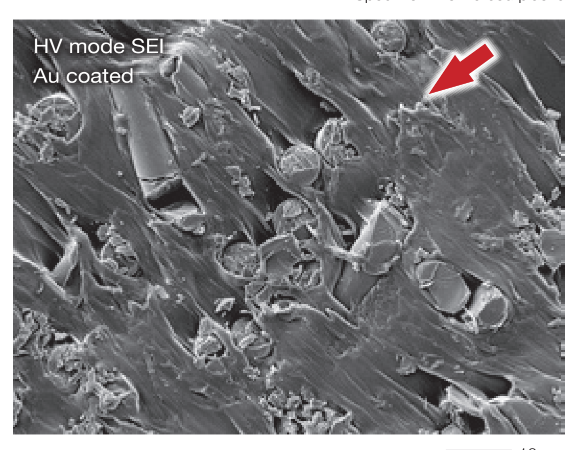
Specimen coater
DII-29010SCTR

Specimen Coater

Coating allows non-conductive specimens or insulating materials to be observed in the SEI (secondary electron image) mode in high vacuum.
Comparing the SEI with the low vacuum BEI (backscattered electron image) allows for detailed examination of the fine surface structure, as indicated by the red arrow.

Specimen: Reinforced plastic





Main Specifications

Direct magnification	×10 to 100,000 Magnification is defined by 128 mm × 96 mm
Display magnification	×24 to 202,168 Magnification is defined by 280 mm × 210 mm
Mode	High-Vacuum mode: Secondary electron image, Backscattered electron image (composition, topographic and shadow, 3D images) Low-Vacuum mode: Backscattered electron image (composition, topographic and shadow, 3D images)
Accelerating voltage:	5 kV, 10 kV, 15 kV (3 stages)
Electron source	Tungsten filament/ Wehnelt Integrated grid
Specimen stage	X-Y motor drive stage X : 40 mm Y : 40 mm
Maximum specimen size:	80 mm diameter × 50 mm height
Specimen exchange	Draw-out mechanism
Pixels for image acquisition	640 × 480, 1,280 × 960 2,560 × 1,920, 5,120 × 3,840
Automatic functions	Alignment, focus, stigmator, brightness/contrast
Measurement functions	Distance between 2 points, angles, line width
File format	BMP, TIFF, JPEG, PNG
Computer	Desktop PC Windows® 10
Monitor	24 inch
Vacuum system	Full-automatic TMP: 1, RP: 1

Options

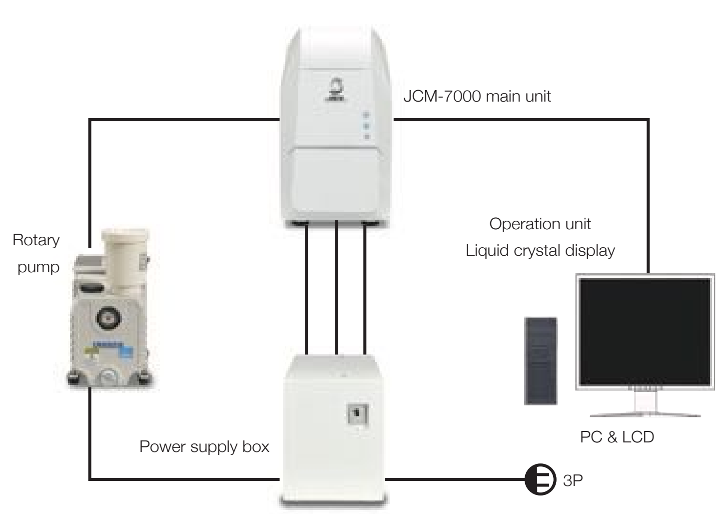
Stage Navigation System
Tilting and Rotating Motor Drive Holder, Tilt: −10 to + 45°, Rotation: 360°
EDS (energy dispersive X-ray spectrometer)
Particle Analysis Software 3*
3D Analysis Software (SMILE VIEW™ Map)
Specimen coater DII-29010SCTR

* The Particle Analysis Software 3 is an option for an EDS system.

Installation Requirements

Power supply	Single phase AC 100 V (120 V, 220 V, 240 V are supported) 50/60 Hz Maximum 700 VA (AC 100 V), 840 VA (AC 120 V), 880 VA (AC 220 V), 960 VA (AC 240 V)
Voltage variation Tolerance	90 to 110 V at power supply voltage 100 V 108 to 132 V at power supply voltage 120 V 198 to 242 V at power supply voltage 220 V 216 to 250 V at power supply voltage 240 V Grounding
Installation room	Temperature: 15 to 30 °C Humidity: 30 to 60% RH (no condensation) Stray magnetic fields: 0.3 μT or less (50/60 Hz, sine wave) Desk: 100 kg or more, with rigidity
Main unit dimensions	(Width) (Depth) (Height) 324 mm × 586 mm × 566 mm
Main unit weight	67 kg

Configuration



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Solutions for Innovation | JEOL

NeoScope™

JCM-7000

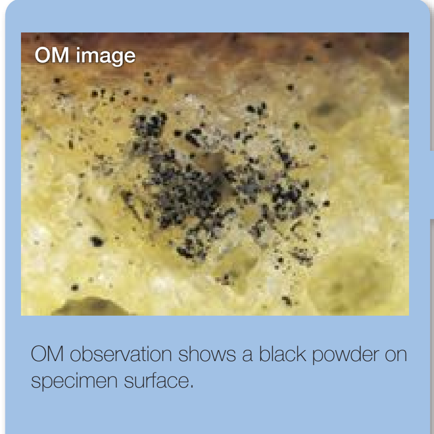
Optical Image to SEM observation with live Elemental Analysis

Accelerate your insight beyond an Optical Microscope

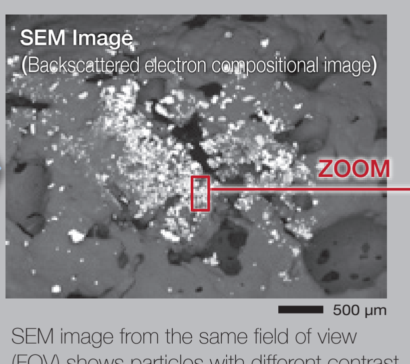
Contaminant analysis

Easy to detect foreign material
Easy to identify elemental composition

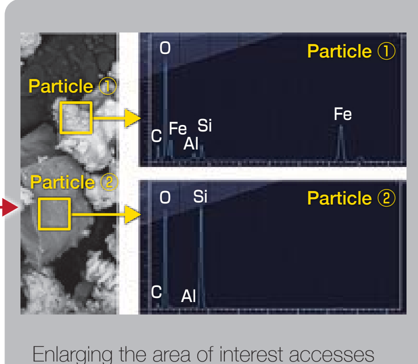
【Example】Analysis of black foreign material adhered on surface of food product



OM observation shows a black powder on specimen surface.



SEM image from the same field of view (FOV) shows particles with different contrast indicating different compositions.

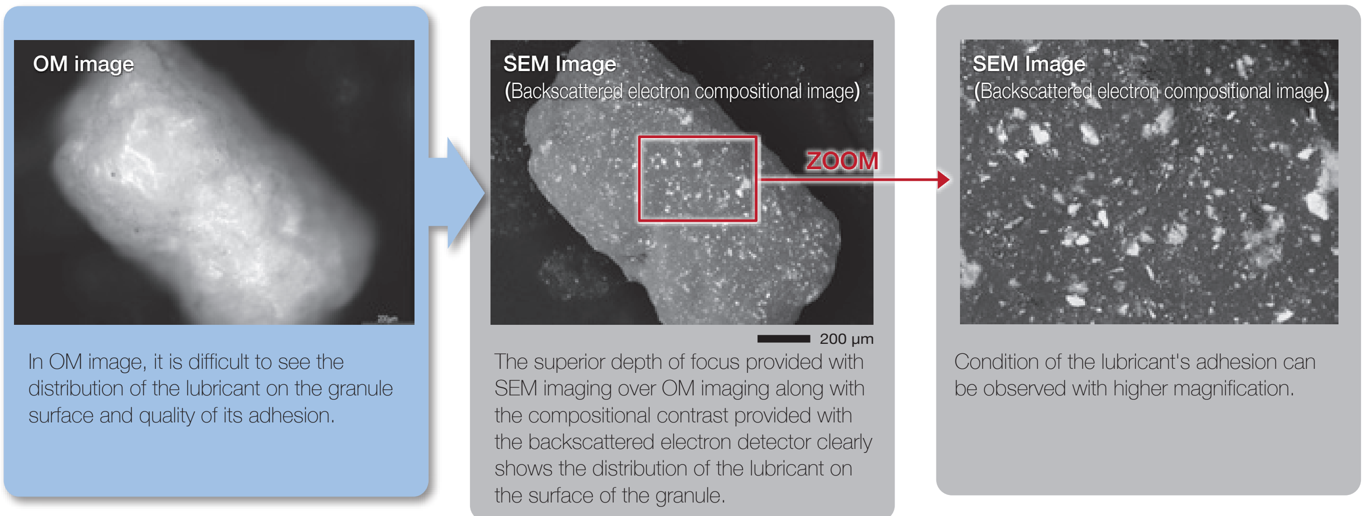


Enlarging the area of interest accesses instant live EDS analysis with main elements identified.

Quality control

Observe detailed surface structures with high resolution and large depth of field not possible with OM imaging.

【Example】 Distribution of lubricant on surface of pharmaceutical granules

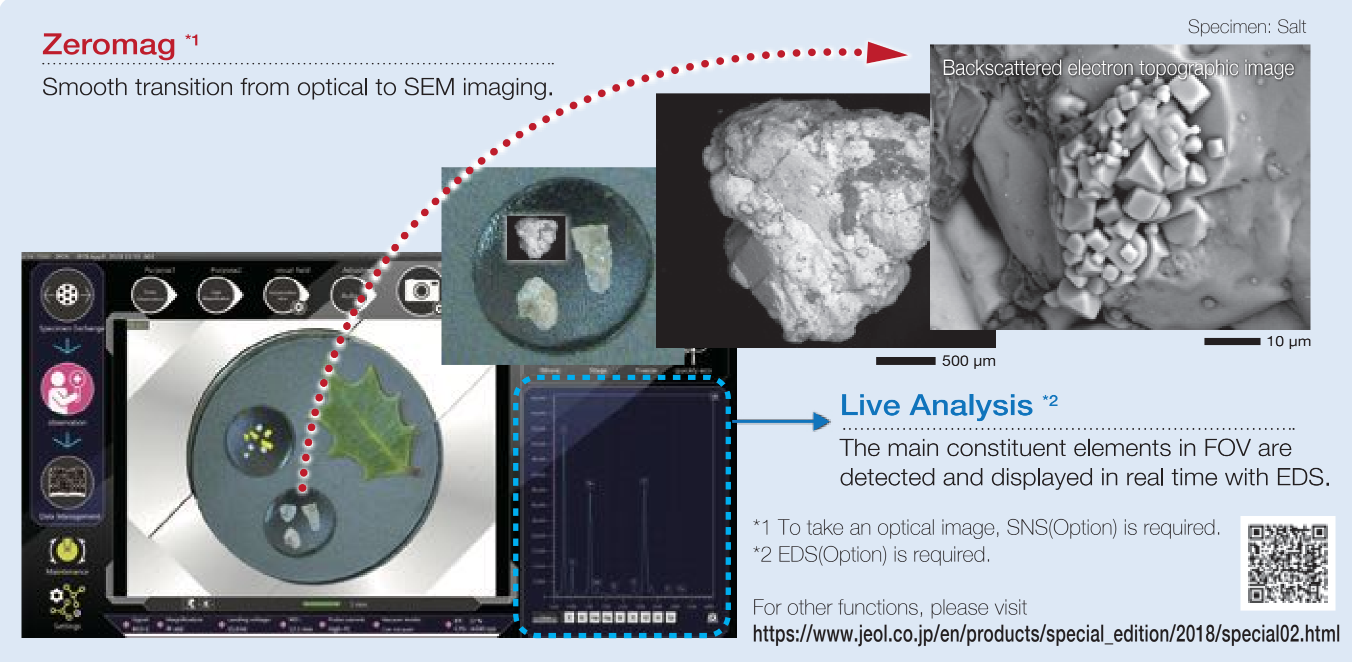


In OM image, it is difficult to see the distribution of the lubricant on the granule surface and quality of its adhesion.

The superior depth of focus provided with SEM imaging over OM imaging along with the compositional contrast provided with the backscattered electron detector clearly shows the distribution of the lubricant on the surface of the granule.

Condition of the lubricant's adhesion can be observed with higher magnification.

Easy-to-use SEM with seamless navigation and live analysis



Zeromag *1

Smooth transition from optical to SEM imaging.

Specimen: Salt

Backscattered electron topographic image

500 μm

10 μm

Live Analysis *2

The main constituent elements in FOV are detected and displayed in real time with EDS.

*1 To take an optical image, SNS(Option) is required.
*2 EDS(Option) is required.

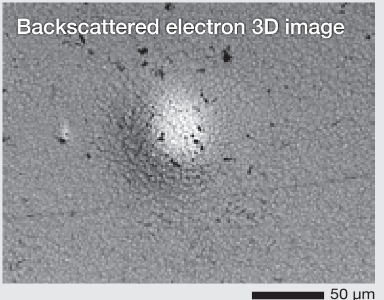
For other functions, please visit
https://www.jeol.co.jp/en/products/special_edition/2018/special02.html

"Live 3D" standard

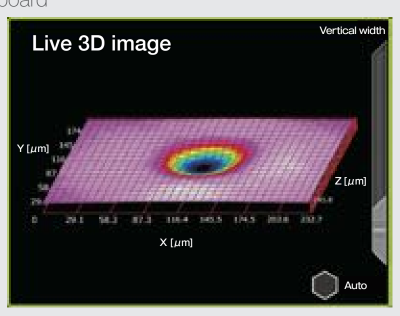
JCM-7000 can display the live SEM and 3D images simultaneously.
In addition to live 3D surface reconstruction, depth information can be observed as well.

NEW!

【Example】 Indentation on a printed circuit board



50 μm



Optional accessories

- ◆ Tilt rotation motorized holder
  Tilt: −10° to +45°, Rotation: 360°
- ◆ Stage Navigation System
- ◆ EDS

Magnification	×10 to 100,000 (Magnification is defined by 128 mm × 96 mm)
Imaging mode	High-Vacuum mode: Secondary electron image, Backscattered electron image (composition, topographic or shadow image),3D Low-Vacuum mode: Backscattered electron image (composition, topographic or shadow image),3D
Accelerating voltage	5 kV, 10 kV, 15 kV (3 stages)
Electron gun	Tungsten cathode with integrated filament-Wehnelt cartridge
Motor stage	X-Y 2 axes: standard
Maximum sample size	80 mm diameter × 50 mm height

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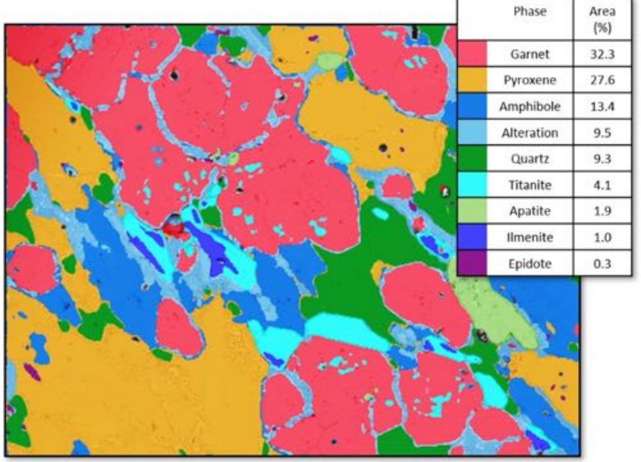
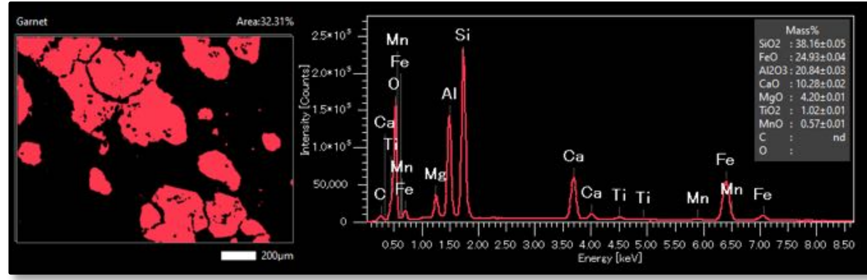
Phase Analysis

Phase Analysis **(EX-36420PHA)**



JEOL's Phase Analysis software expands its fully integrated SEM-EDS solutions to include automated identification and quantification of phases within mixed-mode samples. From quickly visualizing the abundance and spatial distribution of thin film or battery components to quantifying mineral modes in ceramics, natural samples and beyond, Phase Analysis provides a new level of automation to your EDS data analysis and interpretation workflows. Its simple user interface with advanced automated and manual functions benefits a variety of industry and research sectors, including but not limited to: metallurgy, energy and batteries, electronics, ceramics, and geology.



Phase Analysis performs a multivariate analysis of hyperspectral EDS Maps to automatically identify unique phases. A composite map, individual phase maps, fractional areas, spectra, and quantitative results for each phase are automatically calculated and displayed and can be sent to PowerPoint®, Word®, pdf, or .CSV.

From simple two-phase systems like eutectic solders and brazes to complex multi-phase systems like ceramics and geologic samples, Phase Analysis' advanced auto functions make it effortless to implement. Initial phase identification is fully automated with added flexibility to manually adjust the sensitivity of the identification algorithm or combine and re-name phases as needed. For routine workflows, JEOL's Qualitative Analysis Database (QBase) is fully integrated within Phase Analysis to directly match the EDS spectra for each unknown phase to user-defined standard data.

Advanced functions are built-in for optimizing phase identification, including:

- Live preview to review changes before implementation
- Enhanced edge detection and exclusion
- Trace element phase identification

Phase maps can be processed and viewed in multiple ways (Word, PowerPoint, PDF) for reports adaptable to meet your requirements.

Phase Analysis is currently available for offline data processing for most current SEM models. Offline software is included for processing data on another PC.